

Development's Situation at Present and Chinese Countermeasure Currently about Photovoltaic Industry in China

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Abstract

Based on the analysis of International Photovoltaic Industry Development and trend on the basis of PV industry, summarizes the status quo of the development of the industry in the development of China, points out the problems in China, and then, in the light of these problems, put forward a series of countermeasures, to support the healthy development of the industry in China^[1].

Keywords

Photovoltaic Industry; Current Situation and Problem; Countermeasure; In China

Introduction

In September 8, 2010, "the decisions from Chinese State Council is about speeding up the cultivation and development of new strategic industries" in State Council executive meeting examined and approved in principle, made clear formally in energy saving and environmental protection, a new generation of information technology, biotechnology, high-end equipment manufacturing, new energy, new materials and new energy vehicles seven strategic emerging industries^[2]. As an importance representatives of new energy industry, the photovoltaic industry is developing rapidly in China, and which grow into and play a decisive role of force in a new international energy market and China is go on the global PV production country^[3].

Solar Photovoltaic Industry Development Status and Trends in the Global

As new energy industry representatives^[4], photovoltaic industry is development quickly in the whole world, and grows into the international energy market important emerging power; the following is

detailed analysis of the industry in the global status quo and development trend.

First of all, solar energy is inexhaustible, used inexhaustible. The solar radiation projected onto the ground is a 1.3×10^6 tons of standard coal each year. About the one ten thousand times of the world's energy consumption now a year. Could say "It is inexhaustible energy, and be used inexhaustible". Solar energy is not only an energy that can be using once, but also which is a renewable energy. It is rich in resources, which can be used free of charge, and without transportation, no pollution to the environment^[4].

Secondly, the development of solar photovoltaic industry is swift and violent. In 1954, the United States scientists Just Bin and Peel Song first made the single crystal silicon solar cell which has photoelectric conversion efficiency of 4.5%. With the birth of generation technology of photovoltaic power, it can be as a utility of conversion of solar energy into of electrical energy. From 1990 to 2009, the global solar cell output grew 62 times. As a sustainable alternative energy source, it gets to be developing quickly in recent years, and have large areas of the promotion and application firstly in solar energy resource-rich countries, such as Germany and Japan.

Third, from the production perspective, PV capacity will be sustained and rapid growth^[5], according to the prediction from European Photovoltaic Industry Association EPIA. It is an important as a seat for solar photovoltaic power generation that will occupy the world energy consumption in twenty-first Century. Not only to replace part of conventional energy. And it also will become the main body which world's energy supply^[6]. Predict 2040, renewable energy will be above 50% of total energy consumption, solar photovoltaic

power generation will account for more than 20% of the total power, at the end of the 21 century, solar power will account for more than 60%.

Fourth, from the development of the regional perspective, it is possible to be expected to accelerate the development of photovoltaic industry in developing countries in the future^[7]. On one hand, the development of single factory's scale of production on solar cell from 1MWp~5MWp in the nineteen eighties in 20's to 90's 5MWp~30MWp and the 50MWp~500MWp at present. On the other hand, listing enterprises is attracting more and more private and institutional investors; in 2008, the amounts of solar power generation in the field of new investment may be up to 33500000000 dollar^[8]. In addition, through more than 200 of the world's photovoltaic enterprises survey that has been released again greatly increased capacity in 2008 and the first half of the year 2009. If the program can achieve to the expected that we are so, up to 2012, China will have about 32% production capacity of the world, up to 54GW, followed by Europe (20%), Chinese Taiwan (15%) and Japan (12%); but the expected capacity utilization rate will decline further, dropped from 56% in 2007 to 54% in 2008, to 2012 will be decreased to less than 50%^[9].

Fifth, the rapid growth of thin film solar cells should be come from the photovoltaic technology development trend^[10]. On July in 2008, India's prime minister Singer announced India's first national action plan on climate change, in order to respond to the challenge of climate change, India established in 8 items to develop and use new technology as to the national mission^[11]. Among them, solar power generation and utilization of concentrated solar power (CSP) was established as the national solar mission (NSM)^[12]. On April in 2009, the federal government of India made the bill to develop national solar energy, the purpose is to make India become a global leader in the field of solar energy^[13]. This shows, India is expected to realize the PV industry to accelerate the development.

In sixth, the production of photovoltaic cells will continue to substantially reduce the cost. Since 2005, the annual production of thin film solar battery component more than 100MW for the first time, thin film solar battery compound annual growth rate exceeded the overall industry growth, its market share increased from 6% in 2005 to 10% in 2007, up to 12% ~ 14% in 2008. In addition, more and more manufacturers are to develop photovoltaic thin film

solar cell products; in 2008 the company announced that will enhance the production capacity. Predict 2013, film production capacity will be up to 12.9GW, which is accounted for 30% of total photovoltaic products, and will reach 21.4GW in 2014^[14].

Finally, industry concentration could be downward trend further. On one hand, continuously improve the efficiency of the battery. On the other hand, constantly expanding the scale of production and the degree of automation of continuous improvement is the important aspects of solar cell production to reduce the cost of solar cell; scale of production expands 1 times, the production cost will be reduced to 20%. In addition, the commercial battery wafer thickness decreases continuously^[15].

The Status Quo from Development of Solar Photovoltaic Industry in China

Although the solar photovoltaic industry start late in China, but it develops very rapidly, at the same time, there are many problems in behind of the rapid development, we have the following detailed analysis.

China's solar photovoltaic industry was gradually rising in the international market, and quickly became the bright younger generation. The reason is many sides; first of all, the move was double pulled from international market and domestic policy, and was promoted by the huge market of global PV industry. With the global energy situation tightening, as a sustainable alternative energy source, solar photovoltaic power generation get to be developing quickly in recent years^[16]. On September 8, 2010, "the State Council made the decisions about speeding up the cultivation and development of new strategic industries", and this decisions was approved and examined in principle on the State Council executive meeting. Secondly, China have abundant solar energy resources, that is say: China's solar energy rich area is very much where occupies land area of 2 / 3 above, year's amount of radiation more than 6000000000 joule per square meters, annual surface to absorb solar energy equivalent to approximately 1.7 trillion tons of standard coal energy.

The development of China's solar photovoltaic industry have taken shape which's yield occupy the world's fourth^[4]. It has been formed including high purity poly-silicon ingot/wafer manufacturing, solar cell manufacturing, PV modules package and photovoltaic system application and other aspects of the industry chain^[5]. At present, the business volume

in PV industry reached more than 580 in the domestic, the number of employees about 300000 people. In 2009, China's poly-silicon, silicon wafer, solar cell and module capacity respectively occupy global total capacity of 25%, 65%, 51% and 61%; solar cell production is also accounted for the global solar cell production on four into above; The exports amount of photovoltaic industry is about \$15800000000. Emerging with Wuxi Shangde, Changzhou Trina and Yingli, these are a large number of outstanding enterprises^[6]. According to the statistics from the European Photovoltaic Association, Among the 10 strong of the solar cell industry in the global in 2009, our country enterprise is to occupy 4 seats. Shen Lin¹ said, the photovoltaic industry has become China's number could be with the international enterprise on the same starting line to participate in competition in the industry, Yet which is China's most promising globally competitive advantages of strategic emerging industries^[7].

China's solar photovoltaic industry make nine products into exported abroad, energy saving and emission reduction are upside down^[8]. With the global new energy industry's rapid development, China's photovoltaic industry has grown into the world's leading producer of photovoltaic products, its nine into above the PV products are exported to Europe and the United states. Related statistics show, China's solar cell production of more than 2000 MW in 2008, in which more than 97% of exports object mainly exported to Germany, Italy, Spain, Greece and other countries; in 2009, the proportion of exports although reduced, but still accounted for nine into above. Large proportion of new energy products exports abroad, which is bring a grim reality that formed a "new energy exports abroad, carbon emissions at home", this is say energy-saving emission reduction upside down the phenomenon. "Export-oriented" market structure also allows the development of PV industry in China that is heavily dependent on the international market, once the international market appears to fluctuate greatly, which will affect the healthy development of the whole industry chain^[9].

China's solar photovoltaic industry is in backward in domestic photovoltaic application and development potential is tremendous^[10]. Data shows, 2006-2008,

China's newly installed capacity although growth is rapider, but a very low base, the new installation amount is only 0.8% of total global in 2008. In 2009, under the sun solar roof plan and program of incentives, China's solar market installation capacity of 228MW in 2009, annual growth rate is high up to 552%. According to the National Energy Bureau identified development goals, by 2015, solar power installed capacity will reach 5000000 kilowatts; by 2020, solar power installed capacity will reach 20000000 kilowatts. Therefore, a huge market space for development is of our photovoltaic application in future.

The chain development of Chinese solar PV industry is not balanced. On one hand, from enterprises quantity of China's photovoltaic industry chain, It take on pyramid distribution, namely upriver in solar grade silicon material enterprises is relatively less than in the middle, engaged in silicon ingot/wafer cutting enterprises is relatively more, while the downstream engaged in photovoltaic crystalline silicon battery and components of tablets of the enterprise is a substantial increase in the numbers; it is said, in every link of the production capacity of difference. On the other hand, industry chain expansion cycle varies greatly, the upstream poly-silicon purification capacity expansion cycle longer, while the downstream crystal silicon cell and battery pack expansion cycle is short, the whole industry chain expansion cycles are not synchronized, these two factors leading to the development unbalanced of China's photovoltaic industry production chain, which restricted the development of photovoltaic industry in china^[11].

The key technology and core devices of China's solar photovoltaic industry have to rely on imports, which restricts the healthy development of industry. The raw materials of high purity poly-silicon refining technology for Photovoltaic battery are in the United States, Japan, Germany, which be to master the 7 company, and formed a technology block and market monopoly; while China's poly-silicon production equipment technology is not perfect, similar products in the material and power consumption is too large, three waste problems, high production cost, lack of competitiveness. In addition, reduction furnace of chemical vapor deposition (CVD), converter, large-scale hydrogen compressor and other key core technology equipment must rely on imports^[12].

The technical standards and norms of China's solar photovoltaic industry do not sound that may caused by the product quality and reliability low. At present

1 Shen Lin, brigade Russia returned the artist. In 1978 September to 1982 July, graduated from the oil painting department of Academy of Fine Arts Qu Fu Normal University in Shandong, received a Bachelor of Arts degree. In 2008 July by the Russian State Academic Degree Evaluation Committee awarded the master of fine arts education.

domestic has not developed silicon products and solar battery quality standard and product standard, China has promulgated and implemented the photovoltaic technology standards which are mostly photovoltaic product technical standards and norms for the photovoltaic performance quality, which directly affects the PV photovoltaic system technology standards and norms is not complete and incomplete, and related grid-connected photovoltaic power generation technology standard of the missing items are more; particularly large grid-connected PV power station of the relevant standards and technical specifications are blank, and serious impact on China's PV market scale and healthy development. In 41 of PV standards, about 30 are solar cells and components standard, and grid-connected photovoltaic power generation system is directly related to the only 3. Also, no authority, convenient services, the charges are reasonable quality inspection institutions, thus product quality is uneven, some good and some bad.

The system construction of market environment of China's solar photovoltaic industry is not perfect, not conducive to the PV market breed. On one hand, the network problems from photovoltaic power generation have not yet made a breakthrough, on the other hand, support policy is not fulfilled reach the designated position. Our country is in the "renewable energy law" on the photovoltaic clear the price subsidy policy, but the implementation of relevant policies are not in place, in addition to Shanghai and Inner Mongolia, also does not have clear and reasonable fixed feed-in tariff^[13].

The Synergy Mechanism of Photovoltaic Industry and the Traditional Industry

(1) Through the confluence of realization to permeate between photovoltaic industry and traditional industry, can be upgrading of the products, from the use of advanced technology, improve the technology content of photovoltaic product, Realization of photovoltaic industry of high technology, enhancement of photovoltaic industry to adapt to the market competition ability, also can make the photovoltaic industry faces the market directly, promote and improve the photovoltaic industry's development and adaptability, these approaches can achieve photovoltaic industry and the traditional industry development, including the production synergy, management synergy, market synergy in 3 levels^[17].

(2) Despite the low carbon economy environment, photovoltaic industry group and traditional industry

of industry chain of relationship is becoming more and more obvious, but the establishment or maintenance of the industrial chain of this mechanism is still at the initial stage, the internal construction is mainly for enterprises (Group) of low carbon economy industrial chain, and photovoltaic industry development of industrial chain network synergy mechanism has not yet formed under low carbon economy, Based on low carbon industry this can say it is chain of the photovoltaic industry building is still in the act of one's own free, which will the development state of imbalance, collaborative technology also is in lag condition, which could be the theoretical research in academia and government departments play a guiding role and regulation. It is that the emphasis of research in space, time, strength of three dimensions. The order parameter (rate variable) is determined; the system state variables can be established through mathematical model to solve it. The initial proposed order parameter is used as basic criteria to coordination control. At the same time, photovoltaic industry comprehensive performance improvement other related industries comprehensive performance goals also by the same margin growth^[18].

First, assuming that the order parameter: invention patent growth ratio, R&D in investment rate, the rate of carbon emissions per unit of GDP, comprehensive utilization of resources (refers to the main raw material, the extraction rate of utilization efficiency of associated elements), proposed by the empirical analysis to verify the order parameter hypothesis^[19].

In second, in response to the identified parameter, according to our country on the photovoltaic industry and traditional industry coordinated development of controlling index or target, based on the industry chain of different industrial development constraints, such as new products or re-use of resources annual water consumption equality, further research on the order parameter of the dimension of time and intensity and dimensions on collaborative control problem, guidelines for unified given the order parameter control target development on stage division principle and order parameter on the stage of development of the target control standards^[20].

Thirdly, according to the order parameter of the three-dimensional control model, as well as the order parameter of the coordination degree to evaluation model research of industry chain, the model is for the ecological structure of the regulation and the trends of stability regulation mechanism and the control system.

(3) The collaborative management in supply chain Between Emerging industry and traditional industry, Relationships as supply chain shown in figure 2. Among them, the new energy industry in the upstream, new materials and biological industry in the middle, the environmental protection industry in the downstream.

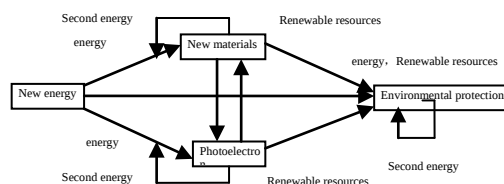


FIG. 2 STRATEGIC EMERGING INDUSTRY AND TRADITIONAL INDUSTRY ECOLOGICAL CHAIN DIAGRAM

Around the main line from this analysis, the collaborative supply chain management is mainly targeted of the burgeoning industry and traditional industry at process of resource utilization, Based on such logic train of thought, seek for the order parameter of synergy regulation of business process of reengineering BPR according to the production, supply, logistics, supplier selection and evaluation of sequential analysis^[21].

Development Strategies

In order to promote China's solar PV industry to development better. I think, the country should implement of proper policy in order to support and encourage the domestic industry in the healthy development^[22].

First, a clear strategic direction, continue to accelerate the development of photovoltaic industry. Photovoltaic industry as the national strategic emerging industry is one of the important fields, which must be aimed at current problems in the development of photovoltaic industry, and accelerate national level new energy industry revitalization planning, and clear the development of photovoltaic industry specific target and construction layout, and as soon as possible to make true implementation planning guidance^[14]; at the same time, country (province, autonomous regions, municipalities directly under the central government) should be based on national level new energy industry revitalization planning to promote the region's photovoltaic industry development planning and implementation of programs. To help industry

revitalization planning should be to strengthen national macroeconomic regulation, straighten development mechanism, increase the core technology research, in order to the scale of application drives equipment industrialization, improve the service system, ensure the photovoltaic industry from the "great leap forward" to "scientific development " span^{[12][13]}.

Secondly, to create the industry technology innovation alliance, strengthen technology research for the key technology and key components. To establish industry leading enterprises, including scientific research institutes in the technology innovation alliance of photovoltaic industry, strengthen the foundation and prospective study of lower cost technology with independent intellectual property rights of the production process and technology, to strengthen our country in the technology of route selection of autonomy^[18]. Through research and development subsidies, play combination advantage from production and learn and research, develop photovoltaic industry high-end technology research and development, key support for clean and high efficiency, low cost and high purity silicon production technology R&D and industrialization, strengthen to study on the key process technology of a comprehensive utilization and environmental protection and other aspects, and inverter, reactor, large-scale hydrogen compressor on key equipment innovation and Study, promote industrial technology the standard. At the same time, we should establish and improve the solar photovoltaic industry's raw materials and product technical standards, testing and certification system, promoting PV industry technology progress, ensure the quality of the poly-silicon and photovoltaic components such as raw materials and the final product, to regulate and guide the healthy development of photovoltaic industry^[20].

Again, improve the supporting infrastructure, and the establishment of a complete industrial policy support system. Draw lessons from the experience of foreign developed countries, increase policy to give aid to strength, in order to further improve the core technical capabilities, improve the industrial chain, to expand the battery assembly production capacity and market share and cultivation of photovoltaic power generation market demand^[21]. One is to improve the supporting infrastructure. To increase the smart grid, UHV transmission line network, large-scale storage and power monitoring technology of development and applications, to solve the photovoltaic power

consumption and power management. The two is to strengthen management on the industry access, the focus on support of enterprises which has related technology research and development capabilities^[16]. From the establishment of enterprises, layout, the registered capital, the requirements of environmental protection, the scale of production, energy consumption, technology, safety and other aspects to normative industry investment, avoid low-level repeated construction project investment, resolutely eliminate technical level is low, serious pollution of small enterprises; and let resource guide to leading enterprises cluster with the industry competitiveness, which are technical quality, less pollution, low energy consumption, scale large, low cost^{[16][10]}. Strengthen consolidation mergers and acquisitions, ensure industry orderly and sustainable development; in particular to strengthen the poly-silicon purification efficiency and environmental protection supervision^[19].

Finally, improve the related tax and subsidy policy. Relying on domestic grid-connected PV demonstration projects and away from the grid, sporadic distribution of off-grid rural photovoltaic power generation project construction, strengthen the cost of PV assessment^[8]; to study a formulation of the compulsory power purchase policy onto photovoltaic electricity consumers, and through the price subsidy and the minimum proportion of photovoltaic power generation planning etc, fiscal subsidies make the photovoltaic investor to be owned a reasonable return, ensure continued market demand; at the same time, along with the cost of photovoltaic power generation progressively closer to the conventional power generation cost, Continue to reduce subsidies and preferential tariff and other preferential policies, true implementation" policy to start the market, with market drive industry"^[18].

Conclusion

Chinese photovoltaic industry and industry chain is formed, but compared with the developed countries, there is still a big gap. At present, the market demand from domestic photovoltaic industry is not big enough; the government support is small and weak, and the lack of a clear incentive policy. The photovoltaic industry R&D and innovation capacity is weakness, the standard of this industry is not perfect, product quality testing system has not been formed, high production cost, energy saving and emission reduction are upside down. Therefore, the government should

make clear the technical bottleneck problems for development of PV industry in China, focus on process of science and technology, increase of national policies and regulations to drive and capital give aid to strength as well as increase personnel training etc.

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